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PARSONS ENGINEERING SCIENCE, INC.
A UNIT OF PARSONS INFRASTRUCTURE & TECHNOLOGY GROUP
5390 Triangle Parkway, Suite 100 • Norcross, Georgia 30092 • (770) 446-4900 • Fax: (770) 446-4910

June 30, 1998

Major Ed Marchand
AFCEE/ERT
3207 North Road, Bldg. 532
Brooks AFB, Texas 78235-5363

Subject: Operations and Maintenance Manual, Record Drawings, and Summary of Initial Results for the Expanded Bioventing System Installed at the Eglin Main Base Old Fire Training Area, Eglin Air Force Base, Florida (Contract F41624-92-8036, Delivery Order 17).

Dear Major Marchand:

This letter transmits three copies of the Operations and Maintenance (O&M) Manual prepared for the expanded bioventing system recently installed at the Eglin Main Base Old Fire Training Area (old Eglin FTA) at Eglin Air Force Base (AFB), Florida. This site is also identified as Installation Restoration Program (IRP) Site FT-28. Appendix A of the O&M Manual contains record drawings for the installed system. This letter also provides a summary of the work performed by Parsons Engineering Science, Inc. (Parsons ES) at Site FT-28 from January through May 1998, and presents initial bioventing system operating parameters and sampling results. Copies of this letter and the O&M Manual also have been sent to Mr. Ralph Armstrong at Eglin AFB. Mr. Armstrong is the current point of contact for extended bioventing activities at Eglin AFB.

SUMMARY OF FIELD ACTIVITIES

In March 1994, Parsons ES installed a pilot-scale bioventing system at the site to evaluate the effectiveness of this technology in reducing petroleum hydrocarbon concentrations in vadose zone soils. The pilot-scale system installed at the site consisted of one air injection vent well (VW1) and three (MPA, MPB, MPC) multi-depth soil gas monitoring points (MPs). The results of the initial bioventing pilot test were reported by Engineering-Science, Inc. (ES, now known as Parsons ES) in 1994.

Based on positive results from the 1-year bioventing pilot test conducted from July 1994 to July 1995, funding was provided by the Air Force Center for Environmental Excellence (AFCEE) to design and install an expanded-scale bioventing system for treatment of vadose zone soils at the old Eglin FTA. An expanded bioventing system, consisting of four additional vent wells (VW2 through VW5), three new MPs (MPD through MPF), a blower system, and associated piping, controls, and electrical service, was installed at Site FT-28. The existing vent well (VW1) and existing monitoring well FT28-03 were also connected to the expanded bioventing system to serve as air injection vent wells. The three MPs (MPA through MPC) installed during the previous pilot

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testing efforts and several groundwater monitoring wells (FT28-03, FT28-04, FT28-05, FT28-07, and IMW-6) installed during previous investigations will continue to be used to monitor system performance. The regenerative blower system that had been used for pilot-scale testing has been removed. System installation was performed by Parsons ES and Kelly Environmental Drilling, Inc. between January 19 and February 11, 1998. The system at Site FT-28 was installed as described in the *Interim Corrective Measures Work Plan for the Expanded Bioventing System, Eglin Main Base Old Fire Training Area* (Parsons ES, 1997). There were no significant deviations from the work plan, except that a 5-horsepower (HP) blower was installed instead of the 3 HP blower specified in the work plan. Figure 1 (attached) shows the site layout with the locations of the bioventing system components. Additional record drawings showing the final design details of the system components are provided in the enclosed O&M Manual.

In May 1998, an interim corrective measure (ICM) for surface soil within the former burn pit at Site FT-28 was completed by BEM Systems of Fort Walton Beach, Florida. The ICM consisted of the following: 1) removal of the mock-up plane from the center of the former burn pit, 2) backfill of the former burn pit with clean, sandy fill, and 3) placement of grass sod over the backfilled area. Two air injection vent wells,VW-1 and VW-4, and four monitoring points (MPA through MPD) are located within the limits of the soil cap. To allow continued access to these points, MPD was constructed with an above grade completion using an 8 inch inner diameter (ID) polyvinyl chloride (PVC) protective casing; and small access vaults, similar to water meter vaults, were installed and secured over MPA, MPB, MPC, VW-1, and VW-4.

SUMMARY OF INITIAL SAMPLING RESULTS

Five soil and six soil gas samples were collected by Parsons ES for laboratory analysis during the expanded system installation and prior to system startup. The soil samples were analyzed by Savannah Laboratories of Savannah, Georgia for benzene, toluene, ethylbenzene, and xylenes (BTEX) by US Environmental Protection Agency (USEPA) Method SW8020; and for total petroleum hydrocarbons (TPH) by Method SW8015 modified. The soil gas samples were analyzed by Air Toxics, Ltd. of Folsom, California for BTEX and total volatile hydrocarbons (TVH) by USEPA Method TO-3. Prior to the collection of laboratory soil gas samples, soil gas samples from all existing and newly installed MPs and the group of groundwater monitoring wells mentioned above, were analyzed in the field by Parsons ES for oxygen, carbon dioxide, and TVH using direct-reading instruments. The results of the field screening were used to select the samples submitted for laboratory analysis. Soil and soil gas results are summarized in Tables 1 and 2 (attached), respectively, and sampling locations are shown on Figure 1.

Soil analytical results indicate low levels of petroleum hydrocarbon contamination in the area of MPF and MPD. The BTEX constituents toluene, ethylbenzene, and xylenes were present in MPF in the smear zone soils at a depth of 35 to 37 feet below ground surface. Toluene, ethylbenzene, and xylenes were also present in the soil samples collected from MPD at depths of 10 to 12 feet below ground surface and in the smear zone soils at 35 to 37 feet below ground surface. TPH was detected in one soil sample

(MPF 35-37') at a concentration of 11 mg/kg. During drilling operations, saturated soils were encountered at depths ranging from 38 to 42 feet below ground surface.

Prior to system start-up, oxygen levels were greater than 10 percent in the majority of the existing and newly installed monitoring points and the groundwater monitoring wells. Low oxygen levels and elevated carbon dioxide levels were present in monitoring point MPC at depths of 5 and 26 feet below ground surface, in MPE at a depth of 5 feet below ground surface, and in MPF at a depth of 36.5 feet below ground surface. The BTEX constituents toluene, ethylbenzene, and xylenes were present in each of the soil gas samples submitted to the laboratory from monitoring points with low oxygen levels (MPC, MPE, MPF). Benzene was present in MPC (26 feet bgs) and MPF (36.5 feet bgs) at concentrations of 0.019 ppmv and 0.15 ppmv, respectively. BTEX constituents were also present in soil gas samples collected from MPD at the shallow and intermediate sampling depths. Initial field and laboratory analytical soil gas results are presented on Table 2.

In general, petroleum hydrocarbon concentrations in soil and soil gas samples collected from MPD, MPE, and MPF were considerably lower than the concentrations detected in the initial samples collected in March of 1994 (VW-1, MPA, MPB, and MPC). These lower concentrations may be attributable one or several of the following:

1) The pilot-scale bioventing system, consisting of air injection at VW-1, was operated from March 1994 to December 1997 at a flow rate of approximately 92 cubic feet per minute (cfm). The operation of the system for almost four years at 92 cfm, most likely enhanced the biodegradation and volatilization of hydrocarbons in soil beneath a large portion of the former burn pit (e.g., MPD)
2) The higher hydrocarbon concentrations observed at VW-1, MPA, MPB, and MPC may related to a former potential migration route of overland transport of hydrocarbons from within the burn pit to the south to southeastern edge of the clay surface and subsequent downward migration into the surrounding sandy soils.
3) Monitoring points MPE and MPF are located away from the primary source area of hydrocarbons (i.e., the former burn pit) and concentrations would be expected to be lower.

INITIAL OPERATION PARAMETERS

The expanded bioventing system was started on February 11, 1998. The air injection rate for each VW was adjusted to allow the system to reach equilibrium and assure optimum air distribution to the contaminated soils. At the end of the initial set up period, air was being injected into VW1 through VW5 at a rate of approximately 35 cfm per well and into FT28-03 at a rate of 43 cfm at a blower pressure of 29 inches of water. A system check was conducted at the site in March 1998. Upon arrival at the site, the blower unit was not in operation. Parsons ES determined that the shut down of the blower unit may have been caused by the infiltration of moisture into the motor starter enclosure. Parsons ES fixed the enclosure to mitigate the potential for future infiltration of moisture and the

blower unit was restarted on March 6, 1998. Pressure response at the MPs after restart ranged from a minimum of 0.0 inches of water at MPC at a depth of 39 feet bgs, to a maximum of 3.7 inches of water at MPA at depth of 38 feet bgs. In general, the lowest pressure responses occurred at each zone of monitoring point MPF, located the greatest distance from the core of the air injection vent well network (VW-1 through VW-5). Based on pressure response measurements, it appeared that the entire area of contaminated soil designated for bioventing treatment was being influenced by the expanded system.

A second system check was conducted on May 11, 1998. Pressure response measurements showed that each monitoring point was being influenced by the expanded system except for MPF (all depths) and MPC at a depth of 38 feet. Although a pressure response was not detected at MPF, oxygen levels ranged from 19.2 percent at a depth of 5 feet bgs to 20.0 percent at a depth of 20.5 feet bgs. Monitoring point MPC, which showed no pressure response at a depth of 38 feet, contained oxygen at 20 percent. At a depth of 26 feet bgs in MPC, a pressure response of 0.05 inches of water was measured and 0.0 percent oxygen was present. Oxygen levels in the remaining MPs ranged from 12.5 to 20.5 percent. Pressure response readings for the system checks conducted in March and May 1998 are presented in Table 3. Soil gas oxygen, carbon dioxide, and TVH concentrations from each system check are presented on Table 4.

OPERATION AND MAINTENANCE

The Eglin Main Base Fire Training Area has been funded for 1 year of system monitoring services under Option 1 of the AFCEE-sponsored Extended Bioventing Project. Option 1 involves O&M support for 1 year and system monitoring at the end of the year. The O&M support period began following system start-up and will continue until February 1999. In February 1999, Parsons ES will return to the site to perform additional respiration testing and soil gas sampling. The results of these monitoring activities will be used to develop recommendations for further action at this site.

If you have any questions or comments regarding the information contained in this letter or in the enclosed O&M Manual, please contact the undersigned at (678) 969-2361 or John Ratz at (303) 831-8100.

Sincerely,

PARSONS ENGINEERING SCIENCE, INC.

Steve Ratzlaff, P.E.
Site Manager

Attachments: References, Figure 1, Tables 1-4

Enclosure: O&M Manual

cc: Ralph Armstrong (Eglin AFB) - 3 copies
John Ratz (Parsons ES - Denver)
726876.43 file

REFERENCES

Engineering-Science, Inc. 1994. Interim Pilot Test Results Report, Hurlburt Fire Training Area (Site FT-39), Eglin Main Old Fire Training Area (Site FT-28), Eglin AFB, Florida. Prepared for U.S. Air Force Center of Environmental Excellence. August.

Parsons Engineering Science, Inc. 1997. Interim Corrective Measures Work Plan for the Expanded Bioventing System, Eglin Main Base Old Fire Training Area, Eglin Air Force Base, Florida. December.

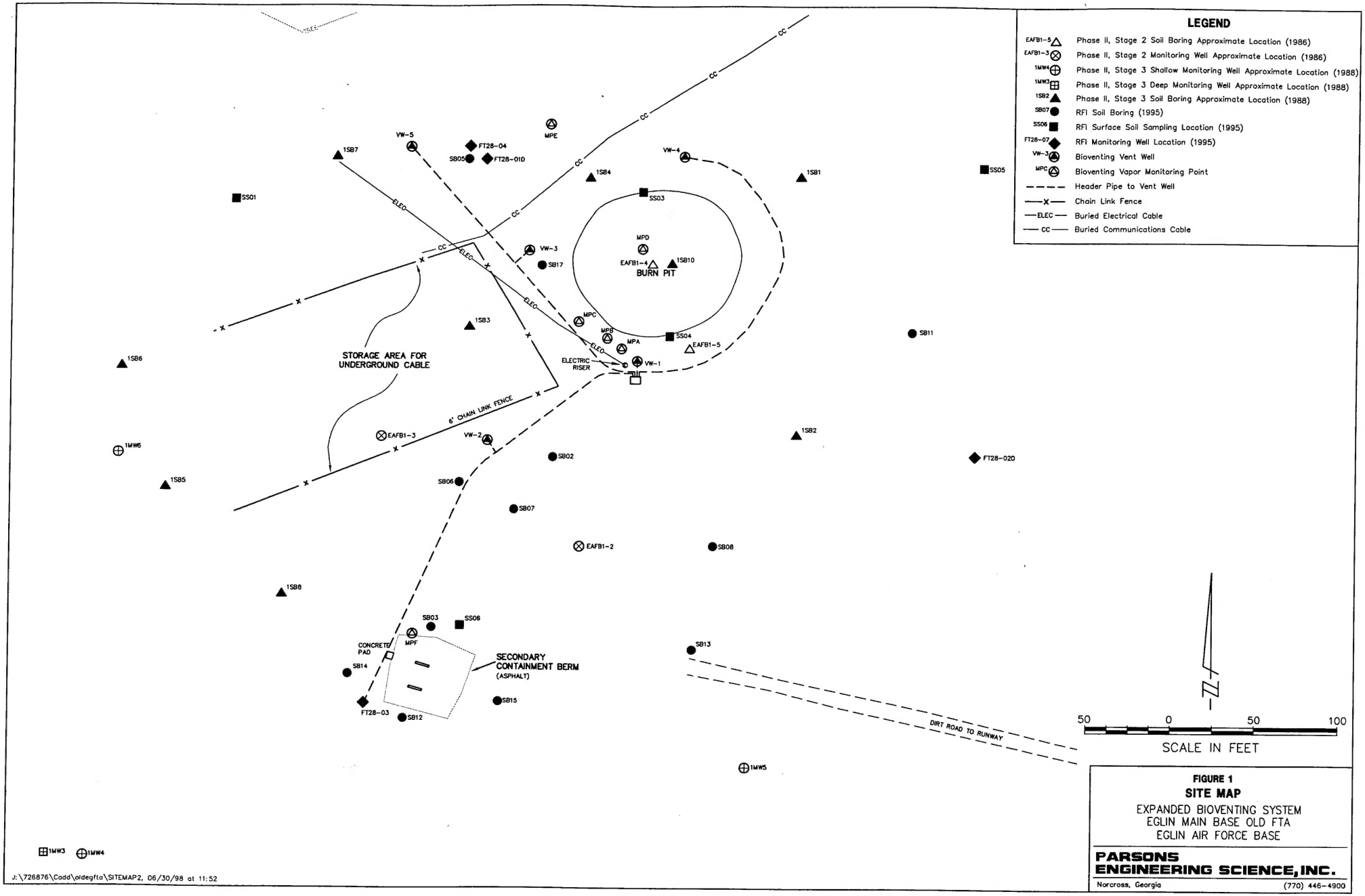

FIGURE 1
SITE MAP
EXPANDED BIOVENTING SYSTEM
EGLIN MAIN BASE OLD FTA
EGLIN AIR FORCE BASE

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TABLE 1
SOIL ANALYTICAL RESULTS

EGLIN MAIN BASE OLD FIRE TRAINING AREA (FT-28)
EGLIN AIR FORCE BASE, FLORIDA

Analyte (Units)[a]	Sample Location-Depth (feet below ground surface)					
	MPD-10-12	MPG-10-12[b]	MPD-35-37	MPE-35-37	MPF-5-7	MPF-35-37
TPH (mg/kg)[c]	11 U[d]	10 U	10 U	11 U	10 U	11 UX[e]
Benzene (µg/kg)[f]	5.3 U	5.2 U	5.3 U	5.3 U	5.2 U	5.5 U
Toluene (µg/kg)	5.3 U	4.6 J	48	5.3 U	5.2 U	13
Ethylbenzene (µg/kg)	5.3 U	3.5	16	5.3 U	5.2 U	5.8
Xylenes (µg/kg)	5.3 U	16	75	1.2 J	1.4 J	39

[a] Soil samples collected 21 and 22 January 1998.
[b] MPG-10-12 is a duplicate sample of MPD-10-12.
[c] TPH = total petroleum hydrocarbons. (mg/kg) = milligrams per kilogram.
[d] U = compound analyzed for, but not detected. Number shown represents the reporting limit.
[e] X = the hydrocarbon pattern in the sample chromatogram did not correspond to patterns of the laboratory's reference standard patterns.
[f] (µg/kg) = micrograms per kilogram.

TABLE 2
INITIAL FIELD AND LABORATORY SOIL GAS ANALYTICAL RESULTS[a/]

EGLIN MAIN BASE OLD FIRE TRAINING AREA (FT-28)
EGLIN AIR FORCE BASE, FLORIDA

Sample Location		Screen Depth (feet)	Field Screening Data: Oxygen (%)	Field Screening Data: Carbon Dioxide (%)	Field Screening Data: TVH (ppmv)[b/]	Laboratory Analytical Data: Benzene (ppmv)	Laboratory Analytical Data: Toluene (ppmv)	Laboratory Analytical Data: Ethylbenzene (ppmv)	Laboratory Analytical Data: Xylenes (ppmv)	Laboratory Analytical Data: TVH (ppmv)
MPA	(S)	5	15.0	2.0	35	---[c/]	---	---	---	---
	(I)	26	16.0	2.1	33	---	---	---	---	---
	(D)	38 (D)	20.8	0.2	14	---	---	---	---	---
MPB	(S)	5	12.0	2.9	140	---	---	---	---	---
	(I)	26	10.0	5.1	240	---	---	---	---	---
	(D)	38	20.8	0.25	120	---	---	---	---	---
MPC	(S)	5	4.0	5.5	200	---	---	---	---	---
	(I)	26	0.0	10.2	400	0.019	0.098	0.064	0.55	63
	(I)[d/]	26	---	---	---	0.015	0.069	0.039	0.37	53.6
	(D)	38	20.8	0.25	200	---	---	---	---	---
MPD	(S)[e/]	5	15.0	2.0	1600	0.20 U[f/]	2.4	3.2	11	570
	(I)	20.5	16.0	0.8	1400	0.020 U	0.021	0.058	0.29	23
	(I)[g/]	20.5	---	---	---	0.020 U	0.015 J	0.056	0.28	24
	(D)	36.5	16.5	1.0	500	---	---	---	---	---
MPE	(S)	5	9.0	6.3	210	0.004 U	0.011	0.027	0.058	14
	(I)	20.5	14.0	3.8	190	---	---	---	---	---
	(D)	36.5	18.0	2.3	140	---	---	---	---	---
MPF	(S)	5	14.5	4.0	98	---	---	---	---	---
	(I)	20.5	18.0	2.0	59	---	---	---	---	---
	(D)	36.5	0.0	12.0	400	0.15	2.2	3.9	12	430

TABLE 2 (Continued)
INITIAL FIELD AND
LABORATORY SOIL GAS ANALYTICAL RESULTS

EGLIN MAIN BASE OLD FIRE TRAINING AREA (FT-28)
EGLIN AIR FORCE BASE, FLORIDA

		Field Screening Data			Laboratory Analytical Data				
Sample Location	Screen Depth (feet)	Oxygen (%)	Carbon Dioxide (%)	TVH (ppmv)	Benzene (ppmv)	Toluene (ppmv)	Ethylbenzene (ppmv)	Xylenes (ppmv)	TVH (ppmv)
VW-1	5-40	19	0.7	18	---	---	---	---	---
VW-2	8-38	18.8	1.7	360	---	---	---	---	---
VW-3	8-38	17.9	2.0	200	---	---	---	---	---
VW-4	8-38	15.5	3.4	200	---	---	---	---	---
VW-5	5-35	14	4.8	240	---	---	---	---	---
FT28-03	37-47	0.5	12.5	2000	---	---	---	---	---
FT28-04	35-45	19.0	2.0	295	---	---	---	---	---
FT28-05	35-45	11.5	7.5	36	---	---	---	---	---
FT28-07	31-41	19.0	2.3	32	---	---	---	---	---
IMW-6[i/]	38-48	20.8	0.25	8	---	---	---	---	---

a/ Soil gas samples collected 23 January and 10 February 1998.

b/ TVH= total volatile hydrocarbon results reported in parts per million, volume per volume. Field screening results include methane.

c/ ---- = not analyzed.

d/ Field duplicate of MPC intermediate depth (I). Sample ID on Chain of Custody: MPH-I.

e/ Analytical results for MPD shallow depth are from sample ID: MPG-Shallow (a field duplicate of MPD-Shallow). Summa canister for MPD- Shallow malfunctioned prior to analysis.

f/ U = compound analyzed for, but not detected. The number shown represents the reporting limit.

g/ Laboratory duplicate of MPD intermediate depth (I). Laboratory sample ID: MPD-I Duplicate.

h/ J = Below detection limit, but supported by duplicate analysis.

i/ Well label in field reads EG3 01-6.

S = denotes shallow depth on laboratory analytical report.
I = denotes intermediate depth on laboratory analytical report.
D = denotes deep depth on laboratory analytical reports.

TABLE 3
MAXIMUM PRESSURE RESPONSE AT SYSTEM MONITORING POINTS

EGLIN MAIN BASE OLD FIRE TRAINING AREA (FT-28)
EGLIN AIR FORCE BASE, FLORIDA

Location	Distance From Nearest VW (feet)	Screen Depth (feet bgs)	Maximum Pressure Response, Mar 98 (inches of water)	Maximum Pressure Response, May 98 (inches of water)
MPA	10	5.0	1.80	1.60
		26.0	1.85	1.70
		38.0	3.70	5.60
MPB	20	5.0	1.75	1.40
		26.0	1.80	1.40
		38.0	0.35	0.30
MPC	40	5.0	1.75	1.30
		26.0	1.75	0.05
		38.0	0.0	0.0
MPD	59	5.0	1.70	1.20
		20.5	1.75	1.20
		36.5	0.75	0.025
MPE	75	5.0	1.20	0.70
		20.5	1.22	0.70
		36.5	0.25	0.05
MPF	50	5.0	0.05	0.0
		20.5	0.10	0.0
		36.5	0.25	0.0

bgs = below ground surface.

TABLE 4
AIR INJECTION INFLUENCE ON OXYGEN CONCENTRATIONS AT SYSTEM MONITORING POINTS

EGLIN MAIN BASE OLD FIRE TRAINING AREA (FT-28)
EGLIN AIR FORCE BASE, FLORIDA

Location	Distance From Nearest VW (feet)	Screen Depth (feet bgs[b/])	Initial Oxygen[a/] (%)	March 98 Oxygen (%)	May 98 Oxygen (%)	Initial TVH[a/] (ppmv)	March 98 TVH (ppmv)	May 98 TVH (ppmv)
MPA	10	5.0	15.0	20.0	20.2	35	72	25
		26.0	16.0	20.2	20.5	33	22	21
		39.0	20.8	20.7[c/]	20.2[c/]	14	NM[c/]	400[c/]
MPB	20	5.0	12.0	14.0	20.0	140	150	32
		26.0	10.0	12.0	20.2	240	180	22
		39.0	20.8	13.75	19.9	120	860	41
MPC	40	5.0	4.0	3.0	15.8	200	280	60
		26.0	0.0	0.0	0.0	400	520	82
		39.0	20.8	20.0	20.0	200	480	100
MPD	59	5.0	15.0	9.0	12.5	1600	350	73
		20.5	16.0	12.0	13.5	1400	230	78
		36.5	16.5	15.5	20.3[c/]	500	140	140[c/]
MPE	75	5.0	9.0	11.5	17.0	210	190	74
		20.5	14.0	15.9	20.0	190	180	72
		36.5	18.0	20.8[c/]	20.3[c/]	140	260[c/]	140[c/]
MPF	50	5.0	14.5	17.0	19.2	98	140	380
		20.5	18.0	13.8	20.0	59	280	480
		36.5	0.0	0.0	19.5	400	840	1800

Notes:
[a/] Initial soil gas measurements taken on January 23, 1998.
[b/] bgs = below ground surface.
[c/] Monitoring point submerged. NM = not measured.